

# Responsive predicates are question-embedding: evidence from Estonian

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## 1 *Mõtlema*: A verbal mystery

- The Estonian verb *mõtlema* ‘think, consider’ is a chimera: it canonically indicates **belief** with an embedded declarative, and **ignorance** with an embedded interrogative:

- (1)    a.    Liis mõtleb, et    sajab vihma.  
              Liis thinks    that falls rain  
              ‘Liis thinks that it’s raining.’ BELIEF
- b.    Liis mõtleb, kas sajab vihma.  
              Liis thinks    Q    falls rain  
              ‘Liis wonders whether it’s raining.’ IGNORANCE

- How can these two starkly different interpretations of *mõtlema*-sentences be derived from its lexical entry and the type of its complement?
- Not merely a lexical quirk: semantically similar ‘contemplative’ verbs in Estonian like *vaatlema* ‘observe’, *mõtisklema* ‘ponder’, and *meelisklema* ‘muse’ exhibit the same pattern.
- *Mõtlema* is a so-called *responsive predicate* (ResP, after Lahiri 2002): it may take both declarative and interrogative clauses as complements.

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- Moreover, in the larger picture, ResPs contrast with rogative and anti-rogative predicates, which only embed interrogatives and declaratives, respectively (Lahiri 2002).

(2) Permissible clausal complements of clausal-embedding predicates

	Declaratives	Interrogatives
Rogative (e.g. <i>wonder</i> )	✗	✓
Anti-Rogative (e.g. <i>think</i> )	✓	✗
Responsive (e.g. <i>know</i> )	✓	✓

- The lexical semantics of clausal-embedders is closely linked to the sorts of complements they may embed (Anand & Hacquard 2013, White et al. 2014, a.o.).
  - ▶ Knowing that *mõtlemä* is responsive can tell us something about its lexical semantics.
  - ▶ In the same vein, the two different interpretations of *mõtlemä*, which depend on the type of its complement, provide a unique window into the nature of responsive predicates.
- If arguments are s(emantically)-selected, the existence of responsive predicates to begin with is surprising (Grimshaw 1979, Pesetsky 1982, 1991).
- Previous accounts of ResP complements are primarily reductive: i.e., they involve type shifting one complement type to the other. These fall into two camps:
  - **Declarative-embedding** (Karttunen 1977, Heim 1994, Ginzburg 1995, Lahiri 2002, Egré 2008, Spector & Egré 2015): ResPs select propositions. Need to explain how interrogative complements are reduced to propositions and why anti-rogatives like *wonder* can't embed declaratives.
  - **Interrogative-embedding** (Uegaki 2016): ResPs select questions. Need to explain how declarative complements are shifted to questions and why rogatives like *think* can't embed interrogatives.<sup>1</sup>
- In a nutshell: how can our semantics for *mõtlemä* derive divergent interpretations, and how can this weigh in on the debate regarding the complement types of ResPs?

<sup>1</sup>Other alternatives exist here: for instance, in Inquisitive Semantics (Ciardelli et al. 2013), declaratives and interrogatives are identically typed to begin with, so ResPs pose no compositional problem whatsoever. I will not go into detail about this line of thinking because it is nearly indistinguishable from the interrogative-embedding view of ResPs, but a closer examination of (anti-)rogative predicates could adjudicate between the two hypotheses. For recent work in this vein, see Theiler et al. (2016), who draw inspiration in no small part from Groenendijk & Stokhof (1984).

Main claim 1: *Mõtlema* and other ‘contemplative’ verbs support an interrogative (sets of propositions)-embedding view of ResPs; their full range of meanings cannot be captured by a declarative-embedding semantics.

Main claim 2: *Mõtlema*-class verbs denote a relationship between an attitude holder and her *contemplation state*, which consists of a set of questions she currently has under consideration.

Roadmap:

- §2 Uses of *mõtlema*, Estonian ResPs, and problems for the declarative account
- §3 Analysis and interpretations of *mõtlema*
- §4 Conclusion and outstanding issues

## 2 The distribution of *mõtlema*

### 2.1 With declarative complements

- The canonical use of *mõtlema* with an embedded declarative indicates belief, just like anti-rogative belief verbs like *arvama* ‘think’ and *uskuma* ‘believe’.

- (3) Inimesed {mõtlevad/arvavad/usuvad}, et olla tugev tähendab mitte  
 people think/think/believe that be.INF strong means NEG  
 kunagi tunda valu.  
 never feel.INF pain  
 ‘People think that being strong means never feeling pain.’

- (4) Siis meie laps mõtleb, et siin on tore riik ja ei põgene.  
 Then our child thinks that here is great country and NEG escape.NEG  
 ‘Then our child will think that this is a great country and won’t escape.’

- There is no factive entailment associated with *mõtlema* (cf. English *know*); a speaker may use *mõtlema* to describe a third party’s beliefs they think to be false.

- (5) Aarne mõtleb, et Helsingi on Rootsis. Ta on nii loll!  
 Aarne thinks that Helsinki is Sweden.INESS he is so dumb  
 ‘Aarne thinks that Helsinki is in Sweden. He’s so dumb!’

- This is like speech act ResPs such as *ütlema* ‘say’, which are nonveridical with embedded declaratives, but contrary to factive ResPs like *teadma* ‘know’.

- Belief verbs typically require propositions as arguments (Hintikka 1962), so if *mõtlem* encodes belief, its declarative-behavior is unsurprising.
- Certain uses of *mõtlem* with an embedded belief are illicit. When embedding predicates of personal taste, *mõtlem* is only felicitous under the anomalous interpretation that the attitude holder believes that opinion to be generally shared or somehow objective.

- (6) Mu õde {arvab/#mõtleb}, et šokolaad on maitsev.  
 my sister thinks that chocolate is delicious  
 ‘My sister thinks that chocolate is delicious.’

## 2.2 *Mõtlem* with interrogatives

- When embedding an interrogative complement, *mõtlem* conveys the inference that the attitude holder is ignorant with respect to the true answer to the embedded question.

- (7) Liis mõtleb, kes ukse taga on.  
 Liis thinks who door.GEN behind is  
 ‘Liis wonders who’s at the door.’

- This inference is not, however, entailed. (7) may be felicitously followed by an explicit denying ignorance (if warranted by the context):

- (8) ...kuigi ta teab, et on Kirsi.  
 even.though she knows that is Kirsi  
 ‘Even though she knows it’s Kirsi (who is at the door).’

- Both kinds of complements can be felicitously conjoined under a single use of *mõtlem*, in which case it carries canonical interpretations with respect to each complement.

- (9) *Context: Your computer won’t turn on. You think the problem is the hard drive, but you aren’t completely sure so you take it to a computer repair shop. You also don’t know if your computer is beyond the point of saving. Later, you tell your friend:*

Ma mõtlen, et mu kõvaketas on katki ja kas nad saavad selle  
 I think.1SG that my hard.disk is broken and Q they can.3PL it.GEN  
 korda.  
 fix.INF  
 ‘I think that my HDD is broken and I wonder if they can fix it.’

- This suggests that the two interpretations of *mõtlemä* are indeed derived from a single lexical entry.

## 2.3 What's wrong with the propositional approach?

- Spector & Egré (2015) note that ResPs like *know*, when embedding an interrogative, encode a relationship between the attitude holder and a *particular answer to the embedded question*.

– This is taken as evidence that ResP complements are reducible to propositions.

- In S&E's view,  $X \text{ ResP } Q$  means  $X \text{ ResP some answer } P \text{ to } Q$ —an interpretative option unavailable to rogative verbs like *wonder*
- Estonian *teadma* 'know' and *ütlemä* 'say' behave in exactly this way:

- (10) Liis teab/ütleb, kes ukse taga on.  
 Liis knows/says who door.GEN behind is  
 'Liis knows/says who's at the door.'  
 $\rightarrow \exists p.[p = x \text{ is at the door} \wedge \text{Liis knows/says } p]$

- S&E leverage this observation in support of a view of ResPs as declarative-embedders.
- No such relation occurs when *mõtlemä* embeds questions—in fact, *mõtlemä* implicates that the attitude holder is **ignorant** of the true answer to the embedded question.

- (11) Liis mõtleb, kes ukse taga on.  
 Liis thinks who door.GEN behind is  
 'Liis wonders who's at the door.'  
 $\rightsquigarrow$  Liis doesn't know who's at the door.

- And (11) certainly cannot be used to mean 'Liis thinks that some specific person  $x$  is at the door.'
- Upshot: There is **no natural way** to reduce the meaning of an embedded interrogative to a proposition under ResPs like *mõtlemä*, contra S&E's generalization.
- This also seems true many emotive factive verbs in Estonian (see appendix).

## 3 A question-embedding approach

- Uegaki (2016) argues for a question-embedding semantics for ResPs. Here, I extend this idea to the domain of contemplatives in Estonian.

- Like Uegaki, I assume a standard Hamblin (1973) semantics, in which the denotation of an interrogative clause is a question: set of propositions comprising complete answers to that question.

### 3.1 Contemplation

- Impressionistically, *mõtlema* with a declarative complement indicates belief in the truth of the embedded clause. But this belief is not entailed.
- For instance, *mõtlema* can be used to describe an imagined situation which an attitude holder is currently musing upon, despite knowing that the situation is counterfactual:

- (12) Ma mõtlen, et dinosaurused on ikka elus, kuigi ma tean, et ei  
 I think that dinosaurs are still alive although I know that NEG  
 ole.  
 be.NEG  
 'I'm thinking about dinosaurs still being alive, even though I know they're not.'

- The common core of meaning among *mõtlema*-type verbs has to do with contemplation: an attitude holder has an issue or scenario they are actively pontificating, without commitment to any particular resolution of that issue.
- Many individual-oriented mental states are linguistically relevant: certain verbs encode relationships between individuals and their beliefs, desires, etc.
- How can the 'contemplative' mental state be formalized? In order to do so, I adopt here a traditional semantics of possible worlds:
  - Propositions denote sets of worlds in the domain of possible worlds  $W$  in which a particular property holds.
- I propose that *mõtlema*-type verbs interact with an agent's *contemplation state* CONTEM, defined as follows:

- (13) A **contemplation state** of an individual  $x$  CONTEM <sub>$x$</sub>  is the set of all questions  $\{Q_1, Q_2, Q_3, \dots, Q_n\}$  that partition a contextually-restricted domain  $W$  of worlds, and that  $x$  is actively considering.<sup>2</sup>

<sup>2</sup>We may want each question in the contemplation set to be able to partition different domains of worlds—the picture here is simplified, though nothing crucial rests on the assumption of a single  $W$ .

- Questions under contemplation give us ways of carving up the set of possible worlds: each cell in the partition corresponding to a particular set of worlds denoted by each answer to the question (à la Groenendijk & Stokhof 1984, Lahiri 2002, or the notion of ‘content’ described in Rawlins (2013)).
- This partition is attentively ‘on the table’ by the contemplator, but crucially, they’re not committed to the actual world being in any one partition in particular.

(14) Sample partitions of  $W$  by various Questions

$Q_1$  partition

$w_1$	$w_2$	$w_3$
$w_4$	$w_5$	$w_6$
$w_7$	$w_8$	$w_9$

$Q_2$  partition

$w_1$	$w_2$	$w_3$
$w_4$	$w_5$	$w_6$
$w_7$	$w_8$	$w_9$

$Q_3$  partition

$w_1$	$w_2$	$w_3$
$w_4$	$w_5$	$w_6$
$w_7$	$w_8$	$w_9$

- With this tool in our kit, the denotation of a contemplative becomes a straightforward relation between the subject and her contemplation state:

$$(15) \quad \llbracket m\ddot{o}t\ddot{l}ema \rrbracket^w = \lambda x_e. \lambda Q_{\langle st, t \rangle}. Q \in \text{CONTEM}_x$$

- In prose, *mõtlema* indicates the embedded question is under contemplation by the subject—but it does not denote any information whatsoever about her beliefs.
- I follow Uegaki (2016) in assuming that ResPs combine with embedded declaratives elevated by the type-shifting operator ID:<sup>3</sup>

$$(16) \quad \llbracket \text{ID} \rrbracket = \lambda p[\lambda q. q = p]$$

### 3.2 Deriving ignorance interpretations

- When an agent who lays mutually exclusive propositions on the table, it’s natural to ask why, exactly, are they weighing these alternatives against one another?
- Absent explicit context to the contrary, it seems each proposition is a live possibilities for truth in the actual world as far as the contemplator is concerned.
  - In other words; a default choice for  $W$  could be the set of worlds compatible with the agent in question’s beliefs.

<sup>3</sup>See Partee (1986) for independent motivation for such an operator

- The natural inference: in describing an agent’s consideration of various alternatives, we mean to say they’re thinking about which one is the *true* answer.
  - This inference is easily overridden by contextual factors: consideration of counterfactual circumstances is of course possible, in the right context.
- While *mõtlemata* *Q* seems similar to *wonder* *Q* in English, their semantics crucially differ.
- Uegaki’s (2016) semantics for *wonder* rule it out from embedded declaratives by asserting that *wonder* presupposes that its complement contains at least two propositions—rendering it anti-rogative.
- While *mõtlemata* is superficially similar in meaning to *wonder* with interrogative complements, it implicates ignorance, rather than entailing it.

### 3.3 Deriving belief interpretations

- *Mõtlemata* *p* indicates that the embedded proposition under consideration constitutes a trivial partition over a contextually domain-restricted *W*.
- It was noted that *mõtlemata* *p* does not entail belief in *p*, but in ordinary circumstances, it is strongly implicated. How does this arise from our definition for *mõtlemata*?
- Contemplation is distinct from commitment: *p* can be contemplated but then explicitly denied without contradiction.
- If we take *W* to be, by default, the set of worlds compatible with *x*’s beliefs, then we derived belief from *x* *mõtlemata* *p*.
- In the absence of explicit contextual evidence that *x* believes  $\neg p$ , *x* *mõtlemata* *p* implies belief, because *x* is only contemplating that belief—unless it is abundantly clear that they believe  $\neg p$ , that she is musing on *p* likely indicates belief.
- However, the perceived commitment of *x* to *p* is implicated to be less than with verbs like *arvama* and *uskuma* which lexically encode belief, via scalar inference.
  - If *x* was known to be fully committed to *p*, use of *mõtlemata* would incur a Gricean (1973) Quantity violation.
- This is corroborated by the tendency to use *mõtlemata* over e.g. *arvama* in hedging, for instance:

- (17) Context: My coworker asks where Mary is. I heard a rumor that she was on vacation in Boston, but I don’t really know her well enough to be really sure.



Ma {mõtlen/?arvan}, et Mary on Bostonis.  
 I think that Mary is Boston.INESS  
 ‘I think that Mary is in Boston.’

- Taste predicates are plausibly infelicitous as complements of *mõtlemä* for similar reasons. A speaker cannot be tepidly committed to her own tastes, so if a more committed alternative to *mõtlemä* is available, it will be preferred.

## 4 Conclusion

- A declarative-embedding semantics for *mõtlemä* is dispreferred, if not implausible, contra the declarative-embedding ResP assumption that all ResP complements are reducible to propositions.
- I introduced a novel type of mental state, *contemplation*, which contains the various issues a person is considering resolutions to, to capture the range of possible interpretations of *mõtlemä*.
- Further investigation into (anti-)rogative Estonian predicates is necessary to evaluate the Inquisitive story of clausal embedding, since it yields the same predictions for ResPs as the interrogative-embedding story.
- Generally, declarative-embedding verbs mean something about belief, and interrogative-embedding verbs mean something about ignorance: could the contemplatives simply have elements of both? (cf. Anand & Hacquard 2013 and references therein on emotive doxastics like *hope* and *fear* as doxastic/preference encoding)

## A Extension to emotive factives

- Many Estonian emotive factive verbs, like *põnevil olema* ‘be excited’, *imestama* ‘be amazed’, and *ahistama* ‘agonize’ are also responsive in Estonian.
- With embedded declaratives, they indicate belief (and an emotive reaction toward that belief). Importantly, the complement of the emotive factive is presupposed:

(18) Miina Härma imestas, et Võrus ka autod on.  
 Miina Härma was.amazed that Võru.INESS also cars are  
 ‘Miina Härma was also amazed that there were cars in Võru, too.’<sup>4</sup>

<sup>4</sup>[http://www.folklore.ee/lepp/kambja/?sel\\_id=8](http://www.folklore.ee/lepp/kambja/?sel_id=8)

- (19) Nad on põnevil, et saavad suurest linnast lahkuda ja minna  
 they are excited that be.able.3PL big.ELA city.ELA to.leave and to.go  
 perega puhkama.  
 family.COM to.rest  
 'They're excited to be able to leave the big city and go on a family vacation.'<sup>5</sup>

- But unlike English, emotive factives are also licit question-embedders in cases where the attitude holder has no particular belief in any outcome of a question.

- (20) *Context: I was going to my home village for the first time in many years, and I really wanted to see my family, but I was not sure they were still there after the war.*

Olin põnevil, kas nad on ikka kõik kodus.  
 was.1SG excited Q they are still all home.INESS  
 'I was excited about whether they were still at home.'

- (21) *Context: I've been eating right and exercising a lot.*

Vaatan peeglist ja imestan, et miks mul sixpack'i veel  
 look.1SG mirror.ILL and am.amazed that why me.ADE sixpack yet  
 imekombel pole.  
 miraculously be.NEG  
 'I look in the mirror and I wonder why I don't have a sixpack yet.'

- That is to say—emotive factive verbs are at least compatible with ignorance toward the answer to an embedded question.
- The similarities between emotive factives and *mõtlemata* are striking—again, the belief/ignorance dichotomy shows up—suggesting there may be a larger pattern at work here.
- Though emotive factives seem the belief/ignorance interpretations to some extent with *mõtlemata*, they differ in crucial ways.
- For one, verbs like *imestama* 'be amazed' are factive with propositional complements, unlike *mõtlemata*:

- (22) Üks itaalia õpetaja sügavalt imestas, et meie gümnasistid on  
 one Italian teacher deeply was.amazed that our students are  
 midagi Dantest kuulnud.  
 something Dante.ELA heard

<sup>5</sup>"Kõige Tervislikum Puhkus", EU Commission pamphlet

‘An Italian teacher was deeply amazed that our students had heard anything about Dante.’

→Our students had heard something about Dante.

- We might bake the factive presupposition into the denotation, as is assumed by e.g. (Roelofsen 2017).
- But the emotive component is also key: we don’t see verbs with a *know*-like meaning with declaratives and a *wonder*-like meaning with interrogatives.
- To what exactly is the emotivity related? Namely: is the ‘surprise/amazement’ encoded by *imestama* a relationship between the attitude holder and a particular proposition, or merely to the resolution of the question?
- Roelofsen et al. (to appear) suggest that emotive factives carry a presupposition that every property highlighted by their complement (i.e. every  $P \in Q$ ) is satisfiable in  $w_0$ , but this predicts that emotive factives cannot embed polar interrogatives, but this is indeed possible in Estonian:

(23) Venemaa ja Puutin on põnevil, et kas Eestis on taandareng või  
 Russia and Putin are excited that Q Estonia.INESS is regression or  
 edasi areng.  
 further development  
 ‘Russia and Putin are excited about whether Estonia will regress or develop further.’

- There are at least some cases in which emotive expressions of this class can embed interrogatives despite indifference to any particular outcome.
  - This may be an indication that a relationship to an embedded proposition per se is not part of the best denotation for these sorts of predicates).

(24) Context: The presidential election, which lasted a long time, has finished. I didn’t like any of the candidates so I didn’t really care who won, but I’m excited that the election is over in any case.

Ma olen põnevil, kes valimised võitis, (ainult) sest kampaania on  
 I am excited who election won (only) because campaign is  
 lõpuks läbi.  
 finally finished  
 ‘I’m excited about who won the election (only) because the campaign is finally over.’

- A denotation of *põnevil olema* needs to be flexible enough to handle where the attitude holder has a particular outcome that clearly excites them, versus ones where the mere resolution of the question is the source of the excitement, like (24)
- And while the above example is compatible with a world in which the speaker knows the result of the election, *mõtlemas*-like ignorance inferences creep up again with embedded interrogatives in other contexts:

(25) *People live such unhealthy lifestyles these days...*

Ja siis imestavad miks haiged.  
and then marvel.3PL why sick.PL  
'And then they wonder why they're sick.'

- More refinement needs to be done in developing a semantics for these sorts of predicates: but the similarities between them and *mõtlemas*-like verbs—namely the belief inference with embedded declaratives and the ignorance inference with embedded interrogatives—are striking.
- A tentative conclusion and line for future work: complements emotive factives in Estonian can also not be easily reduced to propositions. So what is the best denotation for such predicates?

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